Abstract

Two methods and apparatuses are described for hydrazine synthesis through nitrogen fixation induced by photoexcitation of N_2. Both methods of photoexcitation of N_2 for hydrazine synthesis involve a two-photon absorption process. The first method of N_2 fixation with H_2 uses a high-energy short-pulsed Nd: YAG laser with wavelength of 1.06 μm. The two-photon absorption of N_2 is followed by a vibrational-vibrational (V-V) energy transfer that leads to a near-complete population inversion of N_2 vibrational states. The energy separation of these states is larger than the activation energy needed for N_2H_4 formation. The second method of N_2 fixation with H_2O uses a high-energy short-pulsed blue laser with wavelength of 0.4 μm. The two-photon absorption at 0.4 μm pumps N_2 to a highly excited vibrational state, which has enough energy to both dissociate H_2O into H_2 and O_2, and to react with H_2 to form N_2H_4 as in the above direct method of N_2 fixation with H_2.